# Costs and Benefits of Sterilized Foreign Exchange Intervention (i.e. Exchange Rate Protection) in China in the 2000s

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## Abstract

From 2002 to 2010, China ran large surpluses in both the current and capital accounts of its balance of payments, which the People's Bank of China (PBOC) purchased and held at official foreign reserves to avoid nominal appreciation of the currency. Concurrently, with its massive purchases of foreign exchange, the PBOC compelled commercial banks to buy PBOC "sterilization bonds" and raised commercial bank reserve requirement ratios to avoid monetization of its foreign exchange purchases and concomitant upward pressure on the price level (i.e. real appreciation of the currency). Sterilizing foreign exchange intervention, as China did for a decade, constitutes a violation of the implicit rules of a fixed exchange rate regime and as such can be seen as a mercantilist policy of manipulating the real exchange rate to gain, or avoid losing, international price competitiveness, what Corden (1981) termed as "exchange rate protection." This paper sets out the simple theory of the costs and benefits of exchange rate protection and provides back-of-the-envelope estimates of their magnitude in China in the 2000s. It also explores the "other side of the story," the decline in U.S. manufacturing employment in the 2000s, which recent literature attributes to a "China Trade Shock" that allegedly resulted from the U.S. granting Permanent Normal Trade Relations (PNTR) to China in 2001. Here it is argued that the so-called "China Trade Shock" resulted from China's sterilized intervention policy, not the granting of PNTR. The implications of these competing hypotheses are consider in the conclusion of the paper.

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## 1. Introduction

Sterilized foreign exchange intervention is a means by which to escape, if only temporarily, the macro policy trilemma. It is more common that countries resort to sterilized intervention when facing a foreign exchange shortage that is pressuring monetary authorities to devalue the currency. Selling foreign exchange from official reserves and at the same time buying bonds and/or reducing commercial bank's required reserves allows the central bank to keep the exchange rate fixed without a concomitant monetary contraction. But not for long—once the market perceives that the policy is unsustainable, a run on the currency ensues and the game is up (Obstfeld, 1986).

The case of China in the 2000s was different. China faced a large foreign exchange surplus. The Central bank (People's Bank of China, or PBOC) intervened in the market, buying foreign exchange to prevent nominal appreciation of the currency, while at the same time compelling state-owned commercial banks to buy "PBOC sterilization bonds" and raising commercial banks' required reserves to avoid the inflationary consequences that would have resulted otherwise. The PBOC conducted sterilized foreign exchange intervention for almost the entire decade of the 2000s, during which time China amassed several trillion dollars of foreign exchange reserves, enjoyed high real GDP growth and earned the enmity of the United States and other trade partners for its alleged beggar-thy-neighbor policy.[2]

Sterilizing foreign exchange intervention, as China did for a decade, constitutes a violation of the implicit rules of a fixed exchange rate regime and as such can be seen as a mercantilist policy of manipulating the real exchange rate to gain, or avoid losing, international price competitiveness, what Corden (1981) defined as "exchange rate protection." Exchange rate protection, like any other form of protection, would normally be expected to lower net national welfare, unless market failures can be identified to justify the policy. This raises the question of whether China's sterilized foreign exchange policy was in China's own interest. That is the main question addressed here, and tentatively answered in the affirmative.

The paper concludes with a look at "the other side of the story"—the decline in U.S. manufacturing employment in the 2000s, which a large and growing literature attributes to the "China Trade Shock" that allegedly resulted from the U.S. granting Permanent Normal Trade Relations to China in 2001. Here it is argued that the China Trade Shock was not the result PTNR per se, but instead the result of China's adoption of a policy sterilized foreign exchange intervention, which it maintained from 2002 to 2010. The implications of these competing hypotheses and what they mean for U.S. trade policy are addressed at the end of the paper.

[2] Until recently there was scant evidence that imports from China have had a significant effect on American wages or jobs. Richard Freeman (1995) answered "no" to the question "Are your wages set in Beijing?" and opined further that "In the future, I expect that these factors (other than trade) will continue to be more important." But he allowed that "I could, of course, be utterly wrong" (p.31). A string of recent papers argue that he was wrong. Acemoglu, et.al. (2016) presents evidence that imports from China in the 2000s cost around 2.4 million American jobs.

## 2. China's External Imbalance and Sterilized Foreign Exchange Intervention in the 2000s

The underlying facts are clear. From 2002 to 2010, China ran large surpluses in both the current and capital accounts of the balance of payments, which the PBOC purchased and held as official reserves, mainly in U.S. government treasury and agency bonds (Figure 1). China's aggressive intervention in the foreign exchange market prevented nominal appreciation of the RMB until 2005 when, under pressure from the U.S. authorities, the currency was revalued, but to a level nowhere near a market-clearing rate (Figure 2).

Fig. 1. China's Balance of Payments ($ billions)

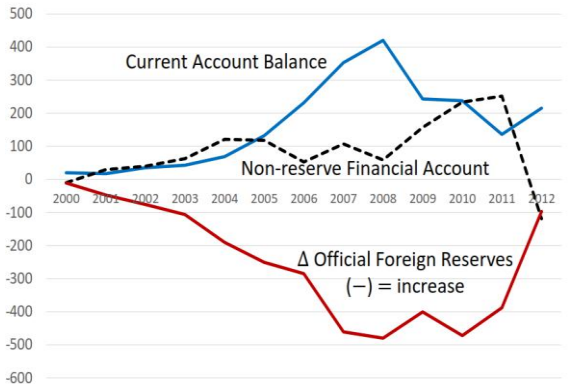
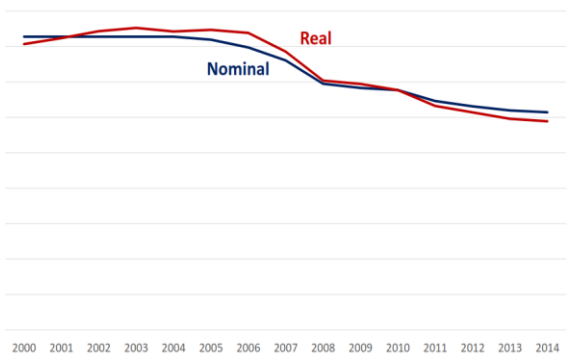



Fig. 2 Nominal & Real RMB/$ Exchange Rate




Source: IMF, International Financial Statistics, online

It is also clear that most of the foreign exchange purchased by the PBOC was sterilized by issuing PBOC sterilization bonds to (mainly) state-owned commercial banks and by increasing commercial bank's required reserves (Figures 3 and 4). In short, China engaged in sterilized foreign exchange to avoid a real appreciation and a consequent loss of international price competitiveness.

Fig. 3 Growth rate of PBOC Balance Sheet

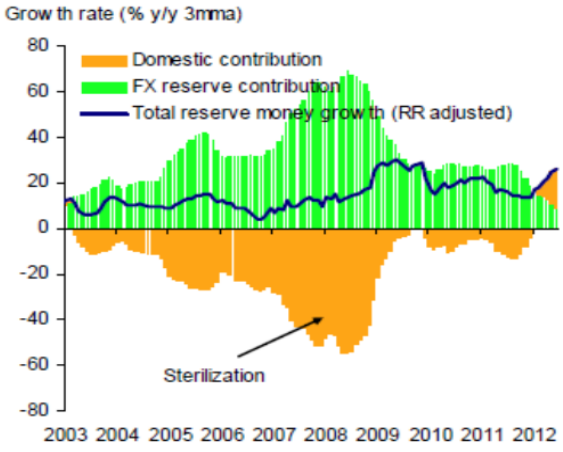
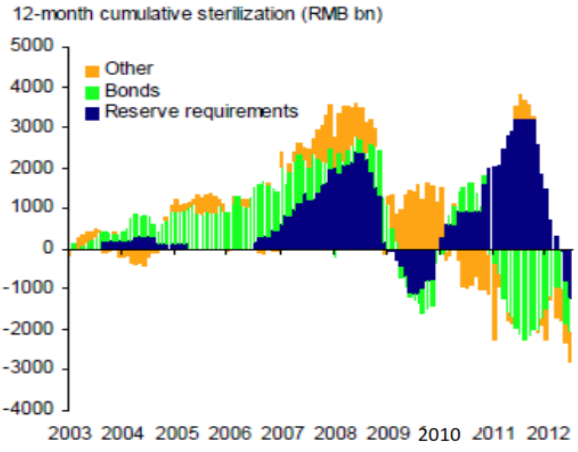



Fig. 4 PBOC Cumulative Sterilization (RMB billions)

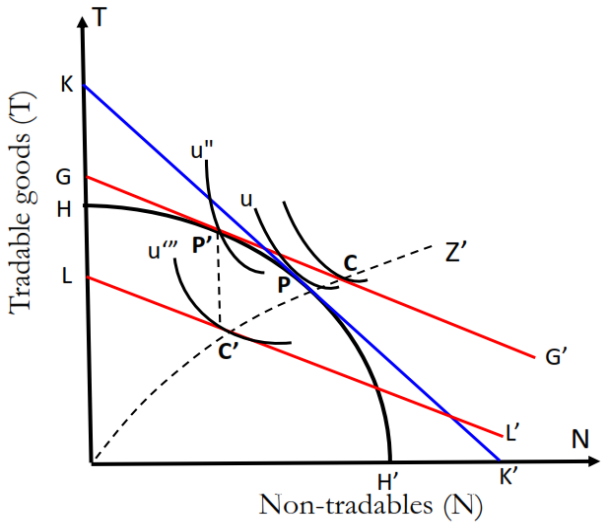



Source: UBS, *China by the Numbers*, May 2014

3. The cost of exchange rate protection in theory

Corden (1981) illustrates the cost of exchange rate protection in a simple, one-period, two-sector (tradable/non-tradable) general equilibrium model of a small open economy (Figure 5).[3] Exchange rate protection, as Corden defined it, is a policy of favoring the tradable goods sector at the expense of the non-tradable goods sector. The policy can illustrated as one of shifting the economy from an initial laissez-faire equilibrium at P to one at P' or, equivalently, of preventing a shift from P' to P. For ease of exposition we initially illustrate the former, though the China case more closely resembles the latter, as discussed below.

Figure 5: The Corden Diagram




The production possibility frontier is represented in Figure 5 by HH'. The relative price of non-tradables ($P_{NT}/EP_T^*$)—i.e. he real exchange rate—at the initial equilibrium (P) is given by the slope of KK'. The market-clearing price of non-tradables ($P_{NT}$) is endogenously determined in the domestic market, while the price of tradables ($P_T^*$) is exogenously determined in the world market. The nominal exchange rate (E)—the domestic price of a unit of foreign currency—is assumed to be fixed by the central bank.

A nominal devaluation lowers the relative price of non-tradables, in Figure 5 from slope of KK' to slope of GG'. The devaluation and shifts production in favor of tradables (P→P'), but shifts consumption in favor of non-tradables (P→C), creating excess demand for non-tradable goods and putting upward pressure on the price of non-tradables until equilibrium is restored at P. Devaluation alone is not an effective exchange rate protection policy, a point that was sometimes lost in policy discussions alleging that China manipulated the exchange rate by fixing the RMB to the dollar (Wolf, 2008).

[3] Corden's one-period model is adopted not only because it is simple, but also because our focus is China's policy in the 2000s, not the implications of reversing its open position in foreign assets sometime in the future.

To be effective, a nominal devaluation must be combined with a policy that reduces demand for non-tradables to the policy-determined level of supply.[4] Two options are available. One would be to combine a devaluation with a consumption tax on non-tradables and consumption subsidy to tradables, yielding balanced-trade equilibrium at P'. The simpler alternative—and the focus of this analysis—would be to combine the devaluation with an expenditure reduction policy that reduces the demand for non-tradables to the policy-determined level.[5] Of course a reduction in expenditure would also reduce the demand for tradables, resulting in a trade surplus of P'C' = GL in Figure 5. The resulting trade surplus must, of course, be matched by an equivalent financial outflow, otherwise the nominal exchange rate would appreciate. This the central bank can achieve through sterilized intervention in the foreign exchange market.

The cost of exchange rate protection is illustrated by lower indifference curves (u' and u") at the exchange rate protection equilibria. In the case of the devaluation-cum-expenditure reduction policy, indifference curve u" represents the utility derived from current consumption. But account must also be taken of future consumption possibilities that arise from the trade surplus and counterpart increase in net foreign assets. Since, at the laissez faire equilibrium (P), no change in net foreign assets is desired (by assumption), the present value of the increase in future consumption is necessarily less than the value of current consumption forgone. In other words, using sterilized intervention for the purpose of exchange rate protection entails a financial loss, which is approximated by the difference in the rate of return on savings invested at home and abroad.

## 4. The identification problem

Corden (1981) introduces an "identification problem." The identification problem arises when a nominal devaluation, a current account surplus and the counterpart outflow of domestic savings occur in the absence of a government policy aimed at achieving that outcome. For example, suppose that, starting from equilibrium P, the return on foreign assets should increase unexpectedly. Domestic saving would flow abroad, exchange rate would depreciate, domestic expenditure would decline and a current account surplus would emerge. All the symptoms of exchange rate protection. However, since there is no sterilized foreign exchange intervention, there is no exchange rate protection.

The identification problem would seem to be present in an influential paper by Song, Storesletten and Zilbotti (hereafter SSZ, 2011) which presents a growth model designed around key features of China's growth experience in the 2000s. The paper notes that "the combination of high growth and high return to capital, on the one hand, and a growing foreign surplus, one the other, is puzzling," as indeed it is. Here it is suggested that the puzzle is explained by China's policy of exchange rate protection via sterilized intervention. SSZ argue that the puzzle is explained by financial frictions that prevented domestic savings intermediated through the domestic financial system from flowing to the highly-productive, highly-profitable, privately-owned, labor-intensive, export-oriented manufacturing sector, and hence flowed abroad where returns were higher than in

[4] Note, equilibrium in the tradable goods sector is compatible with any balance between domestic supply and demand for tradables, since the country can be in surplus or deficit on trade.

[5] Undervaluation is itself an expenditure reduction policy as noted in Song, Storeletten and Zilibotti, 2014.

the less-productive and less-profitable, capital-intensive, domestic market-oriented, but financially-integrated state-owned manufacturing sector.[6]

The hypothesis put forward by SSZ is consistent with many salient features of the Chinese economy in the 2000s and is a plausible in theory, but it is not consistent with one central fact. The surplus of foreign exchange and domestic savings that accumulated in China's domestic banking system in the 2000s flowed abroad via the central bank under its policy of sterilized intervention, not autonomously through globally integrated financial markets (as documented in Figure 1). China's financial market was not globally integrated, as assumed in the SSZ model; it was subject to binding capital controls.[7] Indeed, throughout the 2000s, net private financial resources flowed into, not out of, China, as one would normally expect (again, illustrated Figure 1). In net terms, the outflow of Chinese savings was entirely via the PBOC through its sterilized intervention policy.[8]

5. The benefit from exchange rate protection

Justification for a policy of currency undervaluation (i.e. a subsidy to tradables) in developing countries, generally, and in China, in particular, has been made by Rodrik (2008), citing information and coordination externalities that inhibit spontaneous development of the tradable goods sector. Rodrik was unable to provide any direct evidence of the presence of such externalities or their negative effect on growth, but he was able to show a positive correlation between an index of undervaluation he constructed and per capita income growth in a subset of the 184 countries in his study, namely those with per capita income below PPP $ 6,000 and poor marks on governance. Rodrik's results have been called into question on methodological grounds.[9] Even if taken at face value, the most they do is show that reducing overvaluation increases growth, which is well-known, not least to Rodrik himself.[10] The correlation between Rodrik's measure of undervaluation and growth does not necessarily indicate, as he maintains, that "just as overvaluation hurts growth, undervaluation facilitates it."[11]

The relation between Rodrik's index of undervaluation and per capita income growth for the case of China, which Rodrik described as "uncanny," is shown in Figure 6. It is reproduced here to highlight an important point—namely that in relatively closed, low-income countries with weak institutions and governance, there are no doubt many factors that negatively impact growth performance that are far more important and no doubt overwhelm whatever effect the exchange

[6] The SSZ model is a two-period, two-sector model, the two sectors being (1) private "entrepreneurial firms" that do not have access to bank loans and (2) state-owned, financially-integrated firms that do have access. The agriculture and non-tradable goods sectors are absent from the model.

[7] On China's capital controls in the 2000s see Ma and MCauley (2007); Otani, Fukumoto and Tsuyuguchi (2011).

[8] Song, Storesletten and Zilibotti (2014) build on SSZ (2011) by introducing capital controls and various bank regulations, but fail to introduce the central role of sterilized intervention in explaining the stylized facts of China in the 2000s.

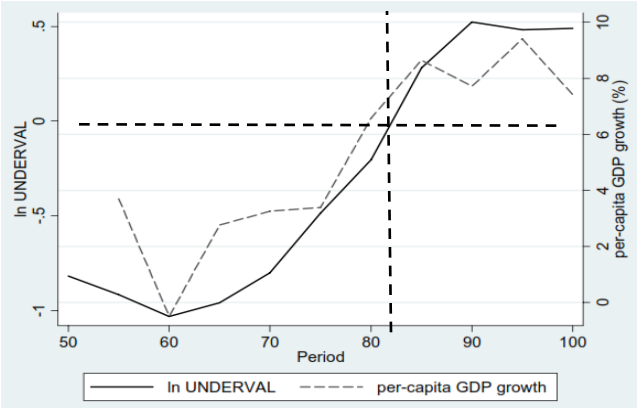
[9] Rodrik (2008) cites Razin and Collins (1997) and Johnson, Ostry, and Subramanian (2007) as evidence of the negative effect of overvaluation on growth.

[10] Rodrik's index of undervaluation is derived from PWT measures of the PPP exchange rate, adjusted for the Balassa-Samuelson effect. In a comment on Rodrik's paper, Woodford (2008) argues that the positive coefficient on undervaluation in Rodrik's growth equations "need not indicate any association between real exchange rates and growth at all—it may simply reflect the positive correlation between the growth rate and itself (p. 422)."

[11] In the absence of externalities, reducing both over- and under-valuation improves efficiency, other things equal, as Bhagwati (1988) illustrates.

rate might have. Certainly that was true in China during the Mao-era of Great Leaps and Cultural Revolutions that left the country, when it ended in the late 1970s, with hundreds of millions of unemployed and disguised-unemployed people residing for the most part in the rural countryside.

Fig. 6 Undervaluation and Growth in China




Rodrik, 2008, p. 45.

Perhaps the most salient feature of the China's economy in recent decades was, thanks to Chairman Mao, its vast reservoir of surplus labor. Unemployment on the scale it was in China at the beginning of the reform era around 1978 was anything but a market failure. Under Mao there were no markets to fail. Hundreds of millions of people were left unemployed as a consequence of political failure, which the authorities began to redress after Deng Xiao Ping came power in 1978. The reforms that began under Deng did not derive from an ideological conversion from communism to capitalism, but rather were taken in a desperate attempt to restore the political legitimacy of the Party, lost during the Cultural Revolution, by creating market institutions that would generate employment and income for the masses (Riedel, 2007, Qian and Wu, 2000).[12]

Between 1980 and 2012, some 343 million new jobs were created in China, 278 million of them (80 percent) in the non-state-owned urban sector.[13] It may be appropriate, therefore, look at exchange rate protection in the 2000s as a policy aimed at preserving the employment and income gains China achieved in the first two decades of economic reform and expanding them further in the 2000s.[14]

[12] The model of W. Arthur Lewis (1954) is recognized as particularly applicable in China. SSZ (p. 205) note that "Lewis' theory captures aspects of the reallocation between rural and urban areas in China, while our focus is on the reallocation within the industrial sector" (i.e. from capital-intensive, state-owned firms to labor-intensive privately-owned firms). Below we show that, in fact, almost all of the increase in manufacturing employment is reallocation from the rural sector and not from the relatively non-tradable parts of the industrial sector.

[13] These numbers are from the China Statistical Year book 2014 (here after CSY 2014), which reports that during the period 1978 to 2002 total employment grew at an annual rate of 2.5 percent, while in the urban sector employment grew at 4.1 percent and in the non-state urban sector it grew at 9.4 percent. From 2002 to 2012, total employment grew at an annual rate of 0.5 and in the non-state urban sector by 5.3 percent.

[14] A number of studies suggest that China had still not crossed the "Lewis turning point" as late as 2012. See Ercolani and Wei (2011) and Das and N'Diaye (2013)

6. Exchange Rate Protection in a Surplus Labor Economy

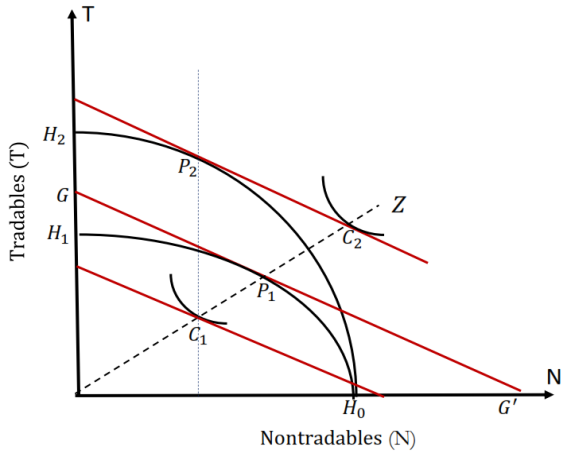
To illustrate exchange rate protection in a growing surplus-labor economy, it is useful to customize Corden's simple one-period, two-sector model. The reservoir of surplus labor, while outside the model, is the source of near-perfectly elastic labor supply to the tradeable and non-tradable sectors at an exogenously given "institutional" wage—essentially the subsistence wage in agriculture, which is approximately the average product of labor (employed and unemployed) in agriculture.[15]

It is useful to redefine "tradables" and "nontradables." Following SZZ, tradables are now defined as the relatively efficient, labor-intensive, export-oriented industrial sector and non-tradables as the less efficient, relatively-closed, capital-intensive, state-owned industrial sector. As in the SSZ model (and the Lewis model too), conventional non-tradables (i.e. services) are outside model.

Following Lewis (1954), it is assumed that surplus labor is drawn out of the rural sector by job-creating investment in the industrial sector. One might reasonably ask where investment comes from in a one-period model. For the sake of simplicity, assume that some fraction of aggregate income is invested in capital goods financed for the most part out of retained earnings—we borrow SSZ's assumption that financial frictions limit the role of financial intermediation in financing investment.

It was noted above that a devaluation alone is <u>not sufficient</u> to achieve exchange rate protection—it must be combined with a dis-absorption policy and sterilized intervention. In a growing economy, a devaluation is <u>not even necessary</u> to achieve exchange rate protection, as illustrated in Figure 7.

Fig. 7 Corden model with technology change in tradables




Suppose for example there is an increase in productivity in the tradable goods sector. Higher productivity in tradables pulls resources out of non-tradables, reducing the output of non-tradables.

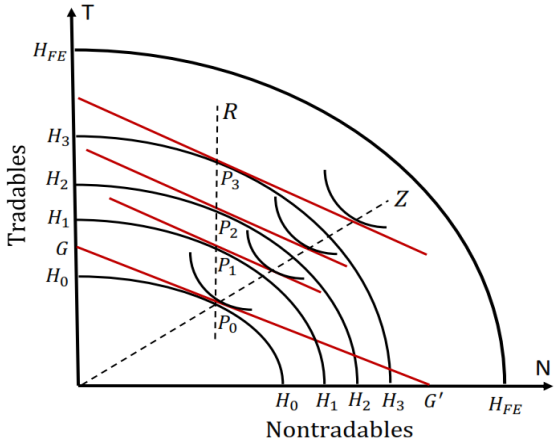
[15] Recall, there are two turning points in Lewis' model—one, at the transition from surplus labor to disguised unemployment (from zero to positive marginal productivity of labor in agriculture) and, two, at the transition from disguised unemployment to full employment (where the marginal productivity of labor in agriculture exceeds the institutional wage and both agriculture and industry operate on neo-classical principles).

But the income effects of increased productivity increase demand for non-tradable, putting upward pressure on the price of non-tradables and real exchange rate (i.e. real appreciation). To protect tradables from a decline in international price competitiveness, the government need only hold expenditure constant and sterilize its foreign exchange purchases. No change in the nominal or real exchange rate is necessary.

The same applies when growth results from an increase in capital. See Figure 8. One might expect that an increase in capital, with the relative price of non-tradables fixed under an exchange rate protection policy, would lead to an increase in output of capital-intensive non-tradables (and decline in output of labor-intensive tradables) via a Rybczynski effect. But here we are assuming the employment in each sector (L) is endogenously determined by the capital stock (K) in each sector. Specifically, $(L_i = K_i/k_i)$ where $k_i$ is the capital-intensity in sector $i\ (= T, N)$ and where, by assumption, $k_T < k_N$.[16]

Since it is assumed that tradables are more efficient, profitable and labor-intensive, the exogenous increase in capital and endogenous increase in labor occur disproportionately the tradables sector, leading to excess demand for non-tradables and pressure on the exchange rate to appreciate. Again, to protect tradables from a decline in international price competitiveness, the government need only hold the level of expenditure fixed and sterilize its foreign exchange intervention. No change in the nominal or real exchange rate is required. In other words, in a growing surplus-labor economy, exchange rate protection may be seen as a defensive policy aimed at preserving international price competiveness to avoid losing income and employment gains.

Fig. 8: Corden model with employment-generating investment




7. The cost and benefit of China's sterilized intervention policy in the in the 2000s

The principal cost of exchange rate protection via sterilized intervention is the opportunity cost of investing domestic saving in foreign exchange reserves rather than in the domestic economy. The principal benefit of exchange rate protection in a surplus labor economy is the opportunity it

[16] With labor endogenously determined by the stock of capital the model becomes a simple AK model. If labor absorption is subject diminishing return the production possibility frontier is a lovely concave function as shown in Figure 8. If subject to constant returns, the production possibility frontier is linear, but the analysis is the same in either case.

provides to maximize the rate of absorption of the unemployed in productive employment in the tradables sector.

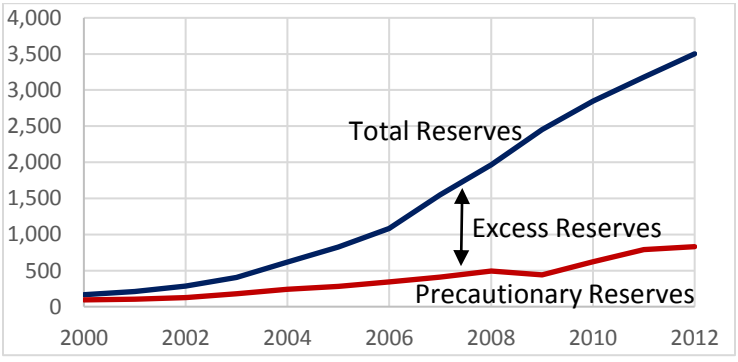
Estimating the cost and benefit of China's exchange rate protection policy requires an estimate of the counterfactual. If the PBOC had not intervened, buying up a large part of China's current and capital account surpluses, the nominal exchange rate would have appreciated, but by how much would it have appreciated? If the central bank had not sterilized its massive foreign exchange purchases, inflation would have been higher, but how much higher would it have been? China's sterilized intervention policy no doubt prevented real appreciation of the currency, but how much of a real appreciation did it prevent? If China had not practiced sterilized intervention, more domestic saving would have been invested at home in relatively inefficient, capital-intensive non-tradable goods sector and real GDP and employment growth would likely have been lower, but how much lower? If China had not practiced exchange rate protection, the labor-intensive tradable goods sector would not have grown as rapidly as did and employment growth would have been lower, but how much lower?

All of the relevant variables for which we require counterfactual values are endogenously determined through the interplay of general equilibrium adjustment in the macro economy. If we had a fully-specified general equilibrium macro model and reliable estimates of the relevant parameters of the model, we could simulate of the counterfactual. Since we do not, we have to be content with back-of- the envelope calculations that may, at the least, suggest whether the net benefit is likely to have been positive or negative.

7.a Opportunity cost foreign reserve accumulation in the 2000s

The first step in determining the financial cost of China's sterilized intervention policy is to estimate the value of reserves accumulated as a result of the policy. This we do by subtracting from total reserves an estimate of those accumulated due to the normal precautionary motive for reserve accumulation. The most common rule of thumb is that for precautionary purposes countries should hold foreign exchange reserves equivalent to about three months of imports (IMF, 2011). Since China's policy of sterilized foreign exchange intervention in the 2000s followed shortly on the heels of the Asian Financial Crisis, it may be appropriate to assume an extra degree of caution on the part of the PBOC and set precautionary reserves of six months of imports, with the remainder ascribed to China's exchange rate protection policy. Figure 9 illustrates the breakdown between precautionary and excess reserves from 2000 to 2012 on this basis.

Fig. 9: China's Precautionary and Excess Reserves ($ billions)



Source: IMF, International Financial Statistics and UBS, *China by the Numbers*, various issues.

Our back-of-the-envelope measure of the financial cost of China's sterilized intervention policy in the 2000s is simply the product annual excess reserves and the differential of the return on reserves versus domestic investment.

The gross returns on China's foreign assets and liabilities in the 2000s have been estimated in a recent study (Huang, 2014). The most striking finding of that study was that the gross return on China's foreign assets in the 2000s was significantly below the return on China's foreign liabilities. This result, according to Huang, derived from the fact that in the 2000s China was "short in equity, long in debt." As Table 1 indicates, the equity that China was particularly short in was FDI, which over the period accounted for 60 percent of China's foreign liabilities; the debt that China was long in was official foreign exchange reserves (held in large part in U.S. treasury and agency bond), which over the period accounted for almost two-thirds of China's foreign assets.

It should be noted that the negative differential between the return on gross assets and liabilities is not entirely due debt-equity return mismatch. Huang's study also indicates that in the 2000s China's FDI assets abroad yielded a return about 6 percentage points lower than China's FDI liabilities. Additionally, China's portfolio equity and debt investments abroad also yielded a lower return than foreign portfolio investments in China. In fact, Huang's estimates indicate that China's foreign exchange reserves were the best performing asset class in China's foreign asset portfolio, earning a return of 2.5 percent over the period 2001-2005 and 4.1 percent over the period 2006-2009.

Table 1: The Levels and Rates of Return on China's Foreign Assets and Liabilities*

| | 2004 | | 2008 | | 2001-05 | 2006-09 |
|---|---|---|---|---|---|---|
| | $ bn | % | $ bn | % | Rate of Return (%) | |
| China's Foreign Assets | | | | | | |
| FDI | 527 | 6 | 1,857 | 6 | 0 | 0.4 |
| Equity | - | - | 214 | 1 | 0 | 0.1 |
| Debt | 920 | 10 | 2,311 | 8 | 0.2 | 0.8 |
| Other portfolio | 1,658 | 18 | 5,523 | 18 | | |
| Foreign reserves | 6,186 | 67 | 19,662 | 67 | 2.5 | 4.1 |
| China's Foreign Liabilities | | | | | | |
| FDI | 3,690 | 57 | 9,155 | 63 | 5.4 | 6.8 |
| Equity | 433 | 7 | 1,515 | 10 | 0.5 | 2.6 |
| Debt & Other | 133 | 2 | 172 | 1 | 0.1 | 0.2 |
| Other portfolio | 2,271 | 35 | 3,796 | 26 | | |

Source: Huang (2014)

While we have an estimate of the return on foreign reserves, we have none for domestic investment in either the tradable or non-tradable goods sectors. Since about 75% percent of foreign direct investment inflows to China in the 2000s were in manufacturing, we may be able to make use of Hoang's estimate of the return on China's FDI liabilities (Liu and Daly, 2011).

The estimated return on China's FDI liabilities is not the counterfactual return on domestic investment in the absence of sterilized intervention that we would want, but it is a place to start. The likelihood is that the return on domestic investment (absent sterilized intervention) would be lower than the return on FDI in the 2000s for at least two reasons. First, in the absence of sterilized intervention the real exchange rate would certainly have appreciated and a larger proportion of FDI would likely have been invested in the non-tradable sector where returns are on average lower. Secondly, sterilized intervention itself in all likelihood had a positive effect on the return to investment in the tradables sector, where a large proportion of FDI was directed.

The return differential between foreign reserves and FDI liabilities, which as reported in Table 1 was on average about 2 percent over the period, in all likelihood overstates the financial cost of China's sterilized intervention in the 2000s. Nevertheless, taking 2 percentage points as the differential return and applying it to excess reverses over the period from 2002 to 2012, the total financial cost of sterilized intervention comes about $100 billion. If we assume a return differential of one percent, then of course the financial cost comes to about $50 billion.

7.b Employment benefit from exchange rate protection in the 2000s

Estimating the employment benefit of China's sterilized intervention is even more problematic than the financial cost. The data are not even adequate to derive a measure of the direct employment effect in export-oriented firms/industries, much less the indirect employment effects that occur through backward and forward linkages to other firms/industries or the employment the multiplier effects that derives from changes in aggregate income.[17]

It is useful, nonetheless, to get a sense of how the overall employment situation in China has changed since the reform process began around 1980. Table 2 presents the aggregate data. Since 1980 some 343 million people have joined the labor force, 278 million of them (81%) in the urban non-SOE (non-state-owned enterprise) sector. In the 1990s, the number employed in the urban non-SOE sector increase by 113 million, 32 million of whom were drawn out of the SOE sector, the rest (78%) being new entrants to the labor force. In the 2000s, the number employed in the non-SOE sector increased by 123 million, of which some 85 million were drawn out of the rural sector.

[17] Acemoglu, et. al. (2014), cited in Footnote 1, report that only 30 percent of the total loss of employment due to Chinese import competition in the 2000s occurred in industries directly exposed; 70 percent of total job losses were due downstream effects of import exposure, with about half of the downstream effects occurring outside the manufacturing sector.

Table 2: Employment in China by Sector: 1980-2012

| | Total | Urban Sector | Urban SOEs | Urban Non-SOEs | Rural Sector | Primary Sector | Industry Sector | Tertiary Sector |
|---|---|---|---|---|---|---|---|---|
| Level of Employment (millions of persons) | | | | | | | | |
| 1980 | 424 | 105 | 80 | 25 | 318 | 291 | 77 | 55 |
| 1990 | 647 | 170 | 103 | 67 | 477 | 389 | 139 | 120 |
| 2002 | 733 | 252 | 72 | 180 | 481 | 366 | 157 | 210 |
| 2012 | 767 | 371 | 68 | 303 | 396 | 258 | 232 | 277 |
| Change in Employment (millions of persons) | | | | | | | | |
| 1980-1990 | 224 | 65 | 23 | 42 | 159 | 98 | 61 | 64 |
| 1990-2002 | 85 | 81 | -32 | 113 | 4 | -23 | 18 | 90 |
| 2002-2012 | 34 | 119 | -3 | 123 | -85 | -109 | 76 | 67 |
| 1980-2012 | 343 | 266 | -12 | 278 | 78 | -33 | 155 | 222 |

Source: China Statistical Yearbook, selected years

It would ideal if we could attach a dollar value to the employment gains (and/or losses avoided) from China's sterilized foreign exchange intervention policy that could be compared to the financial cost of diverting domestic savings to foreign reserves, which we tentatively estimated at $50-100 billion. Since that is not possible, we look at the problem from a different angle by addressing the following question: How many new jobs would it have taken to generate an increase in wage income of $50-100 billion? Since the annual manufacturing wage in the 2000s was not more than about $3,000 per year, the answer is simple: $100 billion/$3,000 = 33 million jobs, which is only about 25 percent of the number of the actual jobs that were created in the 2000s and 14 percent of the number of jobs created over the period 1990 to 2010.

China's sterilized intervention policy in the 2000s constituted a clear case of exchange rate manipulation for the purpose of preserving the international price competitiveness of its export-oriented tradable goods sector, what Corden (1981) labeled "exchange rate protection." Like any other form of protection exchange rate protection entails both costs and benefits. The back-of-envelope calculations reported above suggest that benefits of the policy in terms of the support it provided for the employment of tens of millions of rural unemployed likely outweighed the financial opportunity cost of China's massive accumulation of foreign reserves in the 2000s. In other words, exchange rate protection in China in the 2000s was, in all likelihood, in China's own interest.

8. The other side of the story

There is another side to the story. It is told in a large and growing literature on the job losses in U.S. manufacturing from the "China Trade Shock" of the 2000s.[18] The main cause of the shock, according to this literature, was the granting of Permanent Normal Trade Relations (PNTR) by the U.S. to China upon the latter's accession to the WTO in 2001 (Pierce and Schott, 2012; Autor, Dorn

[18] Acemoglu, Autor, Dorn and Hanson (2016); Autor, Dorn and Hanson (2016); Autor Dorn Hanson and Majlesi (2016); Autor and Dorn (2013); Autor, Dorn and Hanson (2013); Autor Dorn and Hanson (2015); Mion and Zhu (2013); Pierce and Schott (2012); Di Giovanni, Levchenko and Zhang (2014); Donoso, Martin and Minondo (2014); Feler and Senses (2015).

and Hanson, 2016). How would the granting of PNTR have generated a trade shock capable destroying in less than one decade 2.4 million American jobs, given that China had enjoyed MFN status in the U.S. market (albeit conditional on an annual renewal) since 1980? The answer, according to Pierce and Schott (2012) is that, with the granting of PNTR, foreign and domestic firms producing for export to the U.S. no longer faced uncertainty about U.S. tariff rates that would apply were MFN not renewed annually. In consequence:

> "…the decline in uncertainty and expected tariffs associated with PNTR may have increased U.S. firms' incentives to incur the sunk cost associated with opening a plant in China or in establishing a relationship with an existing Chinese supplier. Likewise, PNTR may have provided Chinese producers with greater incentives to invest in entering or expanding into the U.S. market…" (Pierce and Schott, 2012, p.2).

On the face of it, this hypothesis seems plausible. Moreover, it is convenient methodologically, since it makes the trade shock an exogenous event driven by Chinese export supply, not endogenous to U.S. import demand. There is, however, one important consideration omitted in this hypothesis, and several other similar export supply-shock hypotheses that purport to explain the dramatic increase in China's penetration of the U.S. market in the 2000s.[19] What is omitted entirely in this literature is the international price adjustment mechanism, which under normal circumstances would be expected to generate real exchange rate appreciation in response to an export surge, dampening if not extinguishing the export surge. The China export surge was not extinguished or even dampened for more than a decade because China's sterilized intervention policy did not allow the international adjustment mechanism to work. Had China played by the rules of the game, there might not have been a China trade shock at all, or at most a relatively modest one.

Vietnam is a case in point. While China was granted NTR/MFN in 1980, Vietnam had to wait until the US-VN Bilateral Trade Agreement (BTA) was signed in 2001, the year China entered WTO and was granted PNTR status. Six years later, in 2007, Vietnam entered the WTO and was granted PNTR. The BTA in 2002 was a big deal for Vietnam, as it conferred conditional MFN and brought down U.S. tariffs that Vietnam faced on its manufactured exports from the average Smoot-Hawley tariff of 44 percent to the average MFN rate of 4 percent. In the first year of the BTA, Vietnam's exports to the U.S. more than doubled, but the U.S. quickly responded by demanding and getting "voluntary" export quotas on textiles and clothing and by imposing anti-dumping duties on "catfish" and shrimp exports.[20] NTR sparked an export surge, but the U.S. quickly nipped it in the bud, and so the international price adjustment mechanism did not come into play.

The accession to the WTO (and with it the granting of PNTR from the U.S.) was quite another matter. It offered no increased market access for Vietnam, but nonetheless created euphoria in Vietnam and in international financial markets. The domestic private and public sectors went on a spending spree in 2007. Foreign direct investment and portfolio inflows flooded the country with

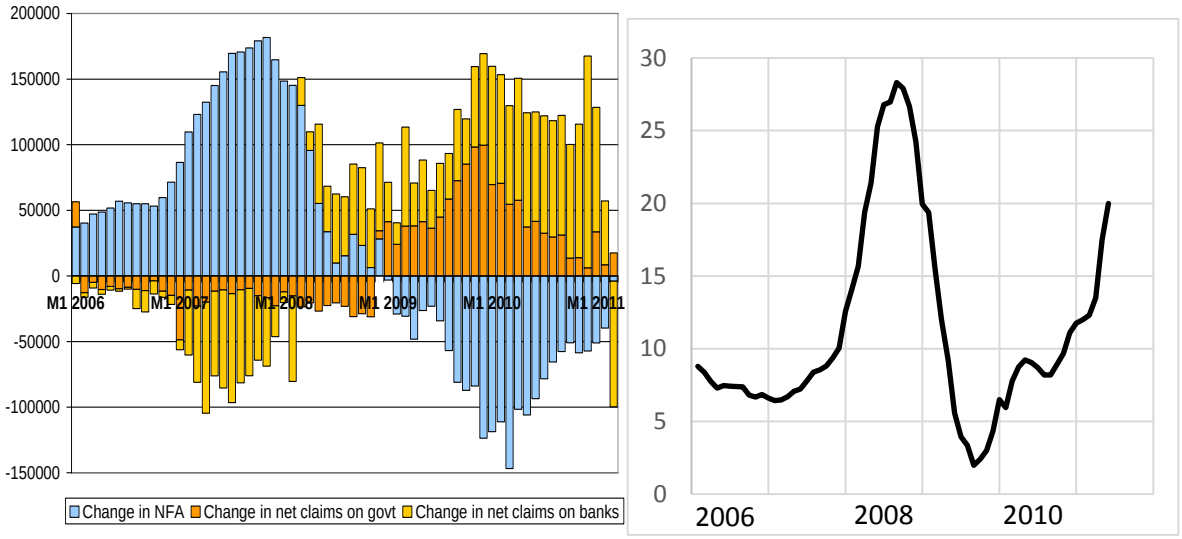
[19] Autor, Dorn and Hanson (2016) cite, in addition to the PNTR, the exogenous effect on China's exports of (i) privatization of state-owned enterprises; (ii) the phase out of restrictions on private firms rights to export; and (iii) greater access to imported inputs. On the latter, see Kee and Tang (2016).

[20] Quotation marks are attached to catfish because in 2001, just a day before the US-VN BTA was signed, the 2002 US Farm Bill was passed with a provision that barred Vietnamese catfish from being labeled catfish. The next year the U.S. imposed anti-dumping duties on Vietnamese catfish cousins.

foreign exchange equivalent to 25 percent of GDP. The exchange rate, which for a decade had been devaluing at a steady rate of 6 percent per year, began to appreciate nominally. The central bank (State Bank of Vietnam, or SBV) began intervening heavily to forestall further nominal appreciation (see Figure 10), the result of which was a surge in money and credit growth and soaring inflation, which jumped in one year from an average of 6 percent to almost 30 percent (year-on-year) in February 2008 (see Figure 11). It was about this time that the hedge funds that had, in 2007, purchased about 60 percent of outstanding dong-denominated government debt revised their expectation about carry-trade profits in Vietnam. A run on the currency ensued in May 2008, which forced the SBV to sell back to the market most of the foreign exchange reserves it had purchased during the spell of WTO euphoria in 2007 and early 2008.

Figure 10: Vietnam: Monthly (year-on-year) changes in base money and its components—foreign exchange reserves in blue, (VND billions)

Figure 11: Vietnam: Monthly (year-on-year) percentage changes in the Consumer Price Index (%)




Source: Pham and Riedel (2012); IMF, International Financial Statistics, online.

WTO/PNTR had a major impact in both China and Vietnam. China was able to ride the wave for a decade by thwarting the international price adjustment mechanism through a policy of sterilized intervention. Vietnam was not able to conduct a successful policy of sterilized intervention and so ran headlong into soaring inflation and a currency crisis in May 2008 (Riedel, 2008).

## 9. Implications

Does it matter whether the 2.4 million U.S. job loss was due to China's decade-long exchange rate protection policy or to granting China PNTR in 2001? For the methodology used to come up with the 2.4 million number, probably not—both PNTR and China's sterilized intervention policy

were exogenous events, the exchange rate policy more clearly so than PNTR. The policy implications of the 2.4 million number, on the other hand, depend a great deal on whether it was the result of PNTR or China's sterilized intervention policy. The PNTR hypothesis plays directly into the politically popular but fundamentally false narrative that U.S. job losses are mainly due to "bad trade deals," deals being in vogue term for negotiated trade agreements.

If U.S. job losses are not due to bad trade deals but instead to unilateral policy measures taken to gain a competitive advantage in the U.S. market, is not the case for retaliation even stronger? The answer is a definitive no! The only economic (as opposed to political) argument for a policy response—even a more modest one than the 45 percent tariff on Chinese imports that has been bandied about by President-elect Trump—is if a retaliatory measure would be in the national interest. There is no evidence presented in "China Trade Shock" literature cited above (or anywhere else I am aware of) that a retaliatory policy response to the China Trade Shock would be in the U.S. national interest. Indeed, there are theoretical reasons and a great deal of empirical evidence to suggest that it would likely harm U.S. national interests due to concomitant losses in consumer welfare and in employment outside the import-competing manufacturing sector.

Is the fact that China's sterilized intervention policy created (and/or protected) 20 times more jobs in China than it cost in the U.S. of any significance? If someone were granted authority to maximize world welfare, it most certainly would be of significance. But since no one has such authority, it does not. As the world is currently constituted, each country formulates its own policy, sometimes in conjunction with other countries, but always (presumably) to serve what those in power (politicians) perceive to be in country's own best interest. Conflicts of interest between countries may arise, but it is not obvious that China's sterilized foreign exchange intervention policy in the 2000s is an example. The analysis presented here suggests that China likely benefitted from the policy. As to whether the U.S. gained or lost, the evidence is incomplete and inconclusive.

American politicians would not agree that the issue is inconclusive, since often they express the view that only three things matter: jobs, jobs and jobs (American ones, of course). Surprisingly, among the most prominent of the authors writing on the employment losses from the China Trade Shock there seems to be some affinity for the politicians' perspective on trade. Autor, Dorn and Hanson (2016) write in the first paragraph of their paper that "theory assures us that under standard conditions the gains to winners are more than sufficient to offset any losses incurred by those suffering adverse effects from foreign competition." But in the second paragraph they write that "trade theory also teaches us that international trade is not generally Pareto-improving." What they are presumably saying is that trade is <u>potentially</u> Pareto-improving, but in reality <u>not actually</u> Pareto-improving because the compensation of losers by winners rarely, if ever, occurs, which is true, but also true about everything that happens in an economy because just about everything that happens in an economy results in winners and uncompensated losers.

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